Space Weather Technical Forecast

Issued on Friday, 14 April 2023 at 12:05 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

---

Space Weather Forecast Headline: Chance of M-class flares (R1-R2 Minor-Moderate radio blackouts) throughout.

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Solar activity has been Low over the past 24 hours, with only minor C-class flares. There are currently eight sunspot regions on the visible disc. AR3281 is slowly becoming clearer, and is now the largest region on the disc with a large leading spot, but it is still difficult to assess the magnetic complexity. AR3280 has continued to grow, with a small delta spot forming. AR3272 has continued to show fading of its intermediate and trailing spots. AR3279 currently appears fairly straightforward, although with numerous spots. AR3282 is also slowly becoming more clearly visible, but again the magnetic structure is still difficult to fully assess. The other regions are small and simple at the present time.
There have been no Earth-directed CMEs observed in available imagery over the past 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind, as observed by DSCOVR at L1, was mostly at background levels throughout. The wind speed varied between 340-430 km/s. The density was average or below. The IMF was weak below 8 nT. The north-south component varied weakly between +6/-5 nT. The phi angle was away from the Sun throughout (positive). Geomagnetic activity was Quiet (Kp 1-2).

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) as measured at GOES16, was at background levels.
The high energy electron flux (greater than 2MeV) as measured at GOES16 was at background levels. The associated 24-hour integrated electron fluence was well below the Active threshold on a steady trend, with 1.69e6 integrated pfu observed at 14/0001UTC.

Four-Day Space Weather Forecast Summary
Solar Activity: Solar activity is expected to be Low to Moderate, with a chance of isolated M-class flares.

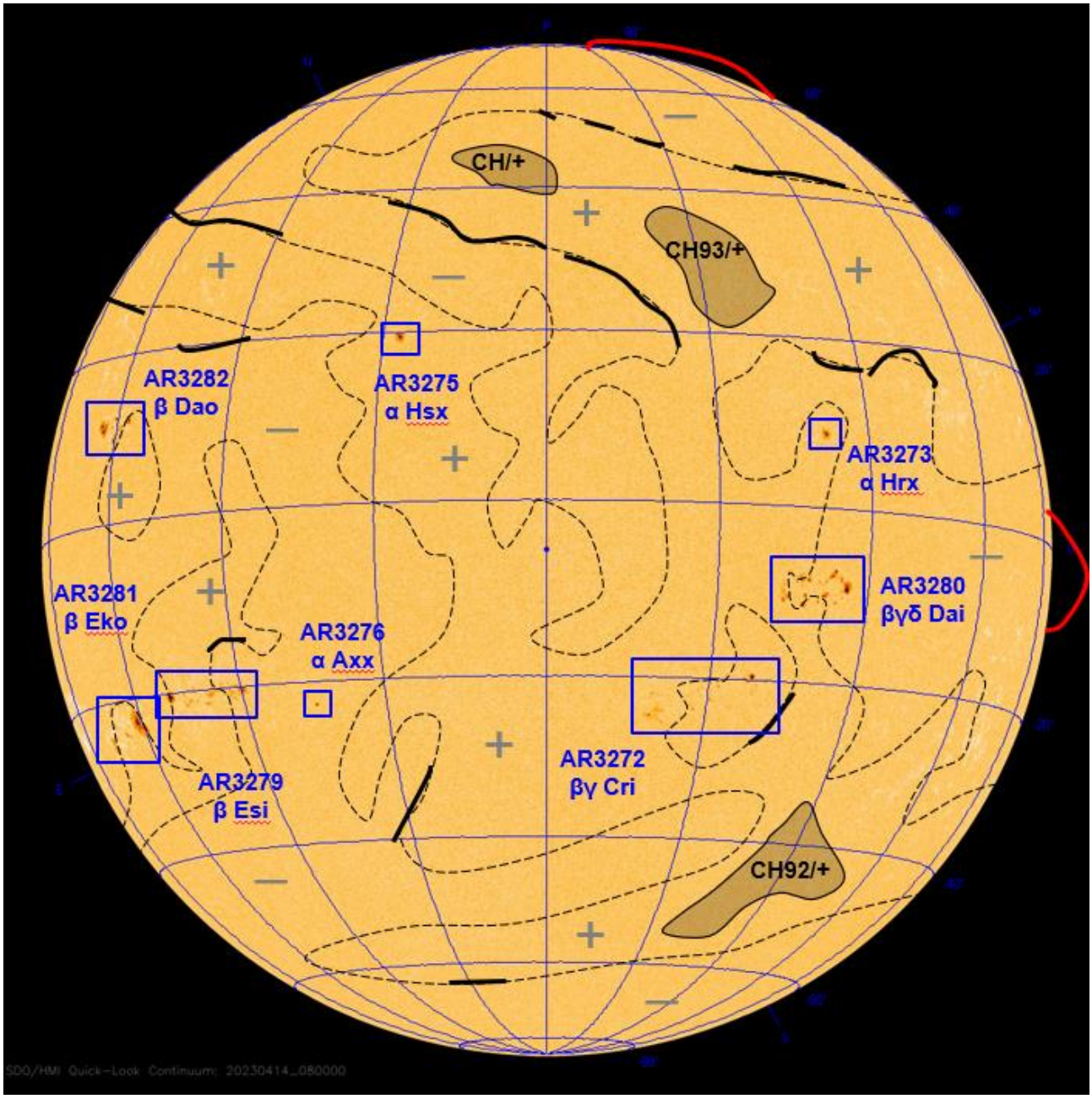
Solar Wind / Geomagnetic Activity: There is a low possibility of a glancing CME arrival on Day 3 (16 April). Otherwise, solar winds are likely to start at background levels, but may become slightly elevated later on 14 April due to positive coronal hole high speed streams.
Resulting geomagnetic activity is expected to generally be Quiet to Unsettled, with a chance of Active intervals, most likely in association with any low confidence transitory CME impact.

Energetic Particles / Solar Radiation: High energy (greater than 10MeV) proton flux is expected to persist at background levels, although there is a slight chance of a greater than S1 event as the various regions transit towards the western hemisphere.
High energy (greater than 2 MeV) electron flux is currently at background levels, but may see a modest rise over the coming days. The associated 24-hour integrated fluence is expected to remain below the Active threshold (1e8 integrated pfu), but perhaps with a rising trend.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

Figure 1. Solar Analysis Valid 14/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

Geomagnetic Storms:

Regarding CMEs, there is a low-level risk of a glancing impact for Day 3 (16 April). This would be a glancing blow from a filament eruption which occurred from the southwest quadrant on 12 April. Confidence surrounding this is low.

In terms of fast wind regimes, Earth is currently in a background solar wind regime. Further positive coronal holes CH92/+ in the south, and CH93/+ in the north carry a potential for Earth to see slightly elevated solar winds from later on Day one (14 April) onwards, however due to their relatively high-latitude positions and positive polarity, any geomagnetic enhancement is expected to remain subdued, with limited MOSWOC Enlil support for any sizeable solar wind enhancement.

The forecast for geomagnetic activity is therefore for generally Quiet to Unsettled conditions throughout, but with a chance of Active intervals, should the aforementioned glancing CME impact materialise.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

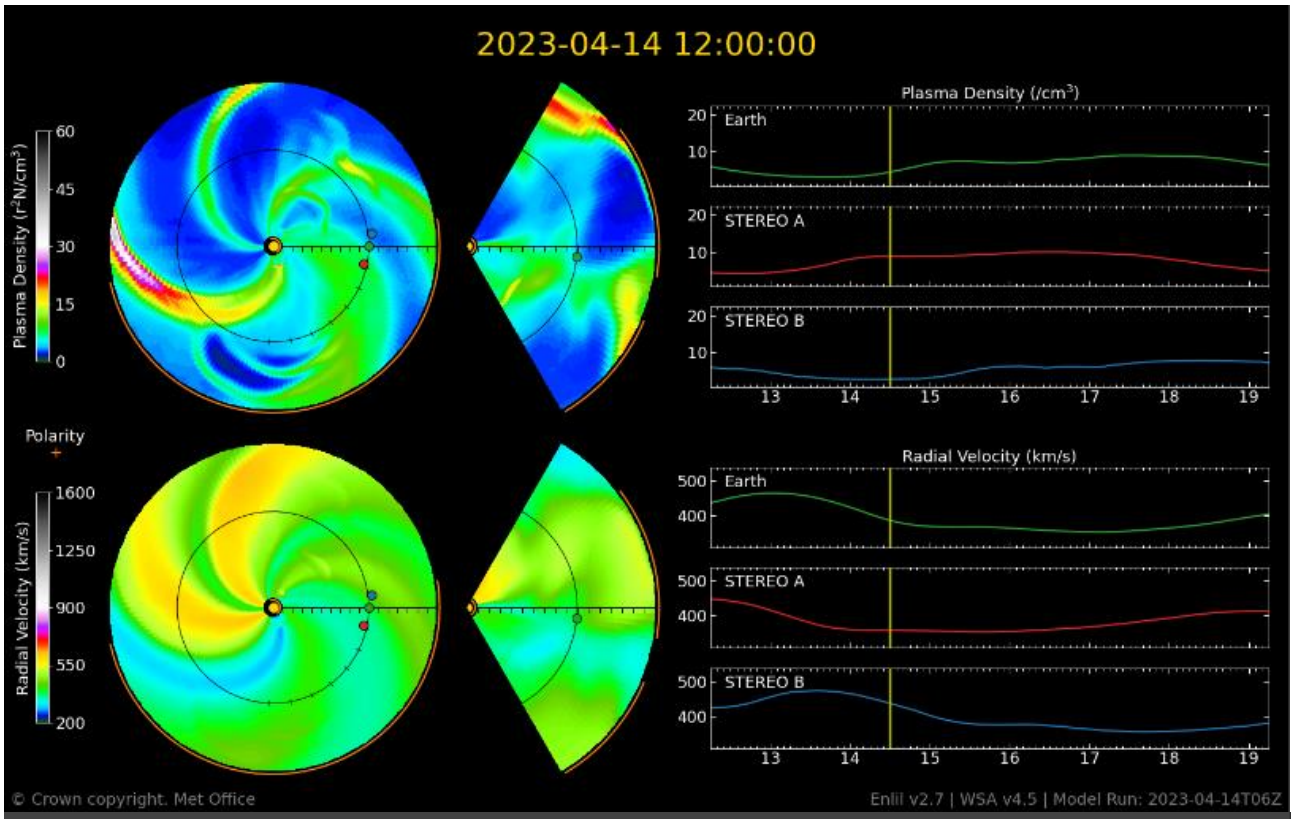
Geomagnetic Activity - Earthbound Coronal Mass Ejections

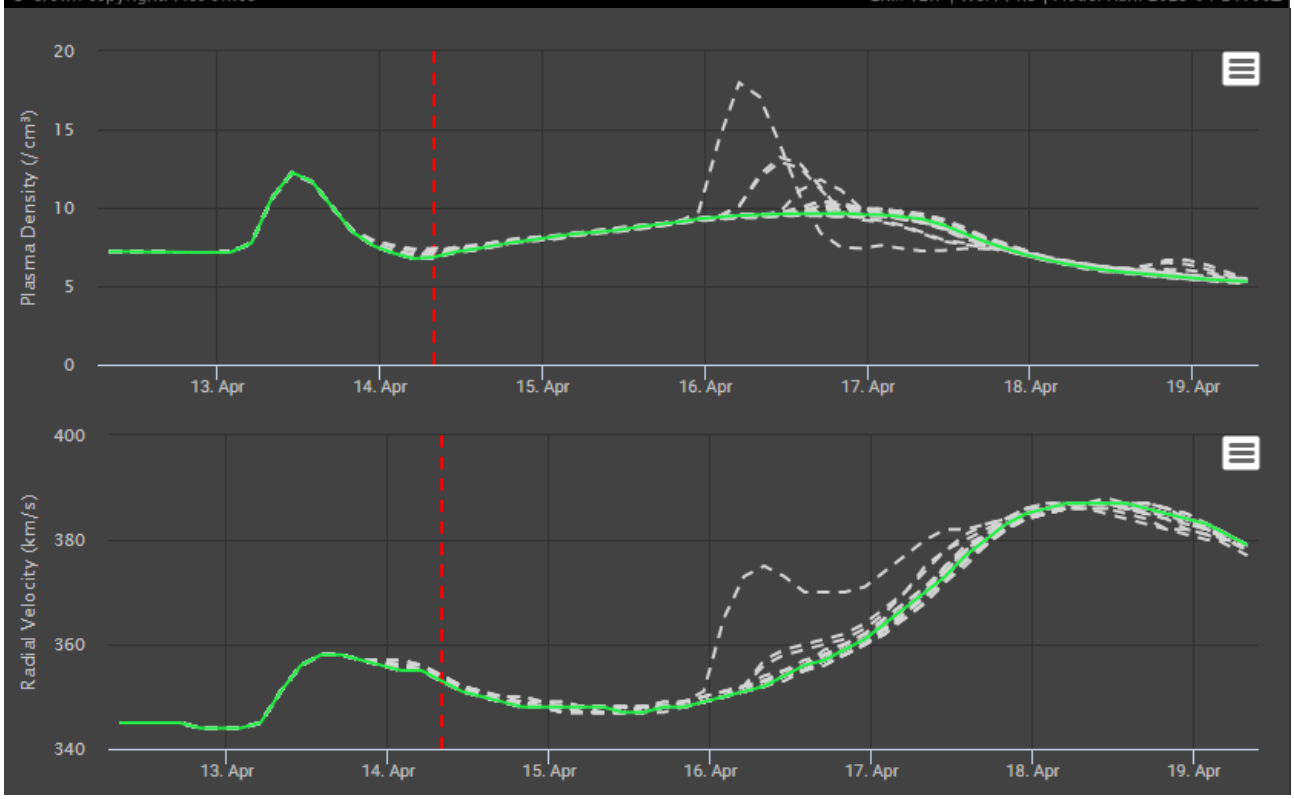
Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
12/0959	Partial	Filament	SW	550 km/s	16/0300 UTC	Low confidence

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

Figure 2: MOSWOC Enlil and ensemble showing the possibility of a CME glancing blow on 16 April. Enlil isn't forecasting a high speed stream over the next few days, which gives lower confidence to the upcoming solar wind forecast.





Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

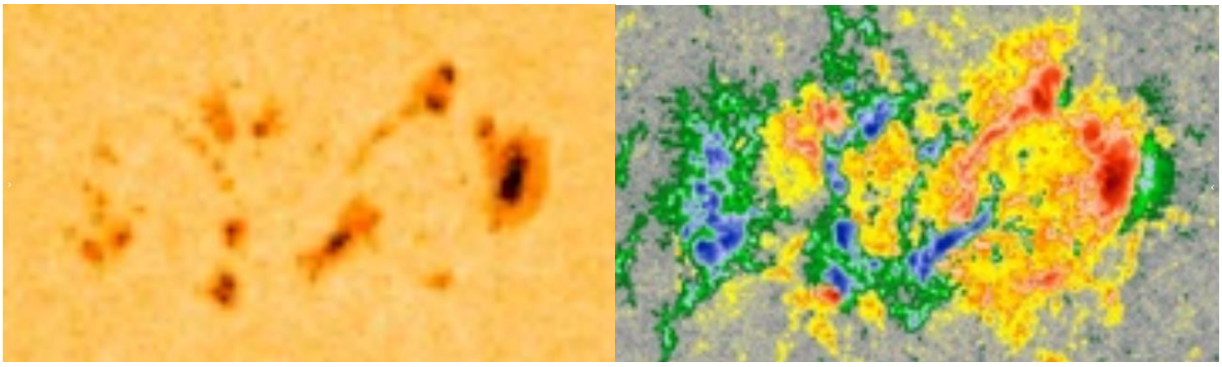
© Crown Copyright 2023. All Rights Reserved.

Radio Blackouts - X-Ray Flares:
Solar activity has been Low over the past 24 hours, with only minor C-class flares. There are currently eight sunspot regions on the visible disc. AR3281 (Eko/Beta) is slowly becoming clearer, and is now the largest region on the disc with a large leading spot, but it is still difficult to assess the magnetic complexity. AR3280 (Dai/Beta-Gamma-Delta) has continued to grow fairly rapidly, with a small delta spot forming. AR3272 (Cri/Beta-Gamma) has continued to show fading of its intermediate and trailing spots and the risk of flaring from this region is declining. AR3279 (Esi/Beta) currently appears fairly straightforward, although with numerous spots. AR3282 (Dao/Beta) is also slowly becoming more clearly visible, but again the magnetic structure is still difficult to fully assess. The other regions are small and simple at the present time.

None of the current front-sided regions are expected to leave the Earth-facing disc in the period. Meanwhile the Carrington locations of up to five previously active regions are due over the eastern solar horizon in the four days. So, while the possible outlook is for an increase in activity, any rise in flare probabilities will be factored into the forecast once they present for analysis on the eastern solar horizon.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	50	50	50	50
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 3: AR3280 has grown rapidly in the last 24-36 hours, and is now showing a small delta spot.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

Solar Radiation Storms - (High Energy Protons):

High energy proton flux (greater than 10MeV), as observed by GOES16, is most likely to remain at background levels through the period, however there is a very gradually increasing slight chance of a greater than S1 event as the various regions transit towards the western hemisphere. The probabilities have been reduced however, due to AR3272 fading significantly.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	10	10
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

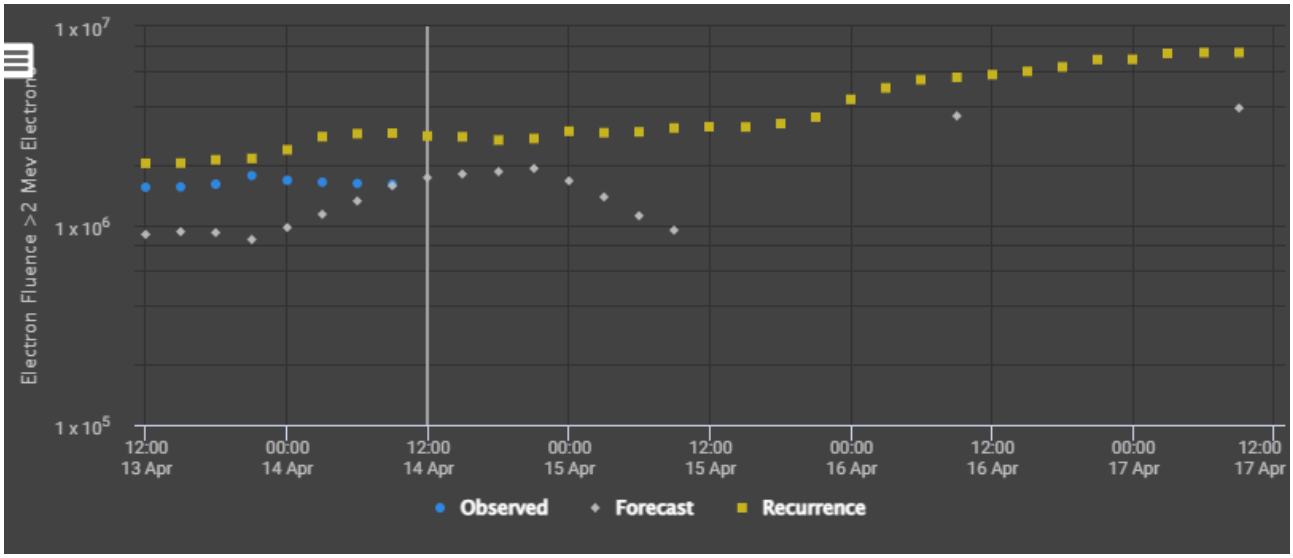
High Energy Electrons Event (≥ 2MeV):

The high energy (greater than 2 MeV) electron flux is currently at background levels, but may rise into the forthcoming UTC weekend in the likely absence of any significant geomagnetic activity. However, any rise is expected to be fairly modest and subject to uncertainty given the potential of glancing CME and HSS effects into the period.

The associated 24-hour integrated fluence is currently expected to be below the Active (1e8 integrated pfu) threshold throughout, but perhaps with a slight rising trend. MOSWOC REFM is suggesting only minor rises and is presently considered to be giving good guidance, albeit with the caveat that there are several low confidence CMEs that could feature in the forecast that REFM does not take account of.

GEO Electron Environment Probability (Exceedance)	Level ($cm^{-2}\ sr^{-1}\ day^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	5	10
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: MOSWOC REFM showing a below Active trend.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.